

THE MOTHS AT CARLYON BAY, CORNWALL RECORDED 1989-1993

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INTRODUCTION

Carlyon Bay is the name given to a complex of beaches south-east of St Austell, Cornwall. There are three beaches called (from west to east) Crinnis, Shorthorn and Polgaver beach. Crinnis Beach is heavily used by holidaymakers, attracted to the site by the presence of Cornwall Colliseum, a leisure park with facilities for adults and children. Fewer people use Shorthorn Beach, which is further from car parking facilities. The long walk required to reach Polgaver Beach means that the site is only sparsely used (it is now a designated nudist beach). In past years, a small train took passengers across Shorthorn Beach to the western edge of Polgaver beach, but this train stopped running in 1992 following major storm damage to the track.

Crinnis Beach consists of a narrow strip of sand backed by a large car park, behind which rise tall cliffs which contain interesting plant communities. Shorthorn Beach is a wilder place. At the western end is a wide flat area above the beach with many kinds of grasses and low-growing plants such as *Potentilla reptans* L., *P. anserina* L. and *Senecio jacobaea* L. Just above the beach to the east of this area there is a small area of dune dominated by *Ammophila arenaria* (L.) Link, backed by a narrow belt of trees (mainly *Salix cinerea* L. and *Betula pubescens* Ehrh.) with abundant *Rubus* sp. and *Crocospia x crocosmiflora* (Lemoine ex Burb & Dean). A small adit flanked by *Alnus glutinosa* (L.) Gaertner runs to the sea. The tracks of the railway enscribe a large circle round a hollow with *Salix cinerea* growing in places in standing water. Between this woodland and the faulted shales of the cliff lies a small heathy area with some *Calluna vulgaris* (L.) Hull, *Erica cinerea* L., *Ulex europaeus* L. and *Pteridium aquilinum* (L.) Kuhn.

Polgaver Beach is similar in many ways to Shorthorn Beach, although the dunes are higher with more *Ammophila arenaria*. The garden introduction *Rosa rugosa* Thunb. ex Murray is abundant here (first recorded here in 1922). On the inland edge of the dunes grow *Salix cinerea* and some *Alnus glutinosa*, leading down into a dune slack with wetland plants such as *Iris pseudacorus* L. Behind a large seasonal pond (often dry in summer) is more willow growing on grassy ground rising up to the high cliffs here. These coastal habitats are rare on the south-east coast of Cornwall.

THE HISTORY OF CARLYON BAY BEACH

The St Austell area is well known for its associations with the china clay industry. North of the town lies the lunar landscape of the china clay tips, white conical hills composed of the waste quartz-sand and undecayed granite, left over after the extraction of kaolin (china clay). 100 years after the foundation of the china clay industry, china clay operations were established on four sites north of Carlyon Bay around 1865. For the next 80 years or so the fine sand and mica residue was carried away from the open mine areas by a system of leats and natural streams, all flowing eventually into a single stream crossing what is now the golf course and then into an adit which discharged this residue onto Shorthorn Beach (Grigg, pers. comm.). In the late 1950s, some of the mine residue was contained on site, but discharges continued from some sites until the mid-1970s. Today, the stream still has a milky appearance. The

deposition of this residue has built up the beach, which is largely composed of coarse grains of quartz. The sand is too coarse for *Ammophila arenaria*, which just sits on top in the areas of finer sand. The areas behind these dunes have been built up by the deposition of china clay waste dredged up from the sea bed near Par Harbour (Lees, pers. comm.). These areas retain moisture even in the driest summer.

Although these beaches are of recent industrial origin, they have become rich in wildlife. There has been much recent interest in the colonization by nature of industrial sites (see Box, 1993, 1994). In Cornwall ECC International Ltd are running an on-going land reclamation programme (Wardell Armstrong, 1993). The importance of the site for wildlife was recognized by South West Water who in 1992 constructed a new sewage pipe across Polgaver Beach into the sea. Although much of the habitat was destroyed during the construction work, restoration work has now taken place to reinstate the dunes and the willow carr. Unfortunately, no account was taken of the moths of the site during this work.

METHODS

The collecting and recording was done by several people (particularly Bill Kittle and Phil Boggis) over a 4-year period, especially in 1992 and 1993. Records were also contributed by Abigail and Simon Boggis, Clarence Brind, David Evans, John Gregory, Paul Siddons, Lee Slaughter and myself. Bill Kittle has had a long association with the site and it was he who first drew my attention to its excellence for moths. Surveying was mainly carried out by lamping and torchlight searching for larvae. Some larvae were bred through by Bill for later identification. Critical species were examined by Paul Siddons and myself.

RESULTS

A detailed list of the species recorded at Carlyon Bay 1989–1993 is given in the Appendix; 331 species were recorded.

Seventeen nationally notable species (see Ball, 1986, updated by Waring, 1993) were recorded, comprising three notable A species, 13 notable B species and one notable

Table 1. Nationally important species found at Shorthorn and Polgaver Beach 1989–1993.

| Name | Classification | Habitat |
|--|----------------|---------------|
| <i>Agrotis ripae</i> Hübn. | Notable B | sand-dune |
| <i>Agrotis trux</i> Hübn. | Notable B | cliff |
| <i>Bembecia muscaeformis</i> Esp. | Notable B | rocks/cliff |
| <i>Catarhoe rubidata</i> D.&S. | Notable B | cliff |
| <i>Conistra rubiginea</i> D.&S. | Notable B | woodland |
| <i>Earias clorana</i> L. | Notable B | damp woods |
| <i>Eilema caniola</i> Hübn. | Notable B | cliffs |
| <i>Eupithecia distinctaria</i> H.-S. | Notable B | coastal areas |
| <i>Hadena luteago barrettii</i> Doubl. | Notable A | cliffs |
| <i>Mecyna asinalis</i> Hübn. | Notable B | cliffs |
| <i>Meganola albula</i> D.&S. | Notable B | coastal areas |
| <i>Mythimna litoralis</i> Curt. | Notable B | sand-dunes |
| <i>Mythimna l-album</i> L. | Notable B | coastal areas |
| <i>Mythimna putrescens</i> Hübn. | Notable A | cliffs |
| <i>Polymixis xanthomista</i> Hübn. | Notable A | cliffs |
| <i>Phycitodes maritima</i> Tengst. | Notable | cliffs/beach |
| <i>Schranksia taenialis</i> Hübn. | Notable B | damp woodland |

Table 2. All species recorded at Carlyon Bay classified according to habitat (excluding migrant species).

| Habitat | Species numbers |
|--------------------|-----------------|
| Dry woodland | 40 |
| Sand-dune | 32 |
| Cliff | 30 |
| Scrub | 24 |
| Wet woodland | 22 |
| Wetland | 10 |
| Conifer woodland | 7 |
| Generalist species | 153 |
| Total | 318 |

Table 3. Migrant species found at Shorthorn and Polgaver Beach 1989-1993.

| | |
|----------------------------------|--------------------------|
| <i>Agrotis ipsilon</i> Hufn. | dark sword-grass |
| <i>Autographa gamma</i> L. | silver Y |
| <i>Earias clorana</i> L. | cream-bordered green pea |
| <i>Heliothis armigera</i> Hübn. | scarce bordered straw |
| <i>Mythimna albipuncta</i> D.&S. | white-point |
| <i>Mythimna l-album</i> L. | L-album wainscot |
| <i>Mythimna loreyi</i> Dup. | the cosmopolitan |
| <i>Mythimna vitellina</i> Hübn. | the delicate |
| <i>Nomophila noctuella</i> D.&S. | rush veneer |
| <i>Orthonama obstipata</i> F. | the gem |
| <i>Peridroma saucia</i> Hübn. | pearly underwing |
| <i>Rhometra sacraria</i> L. | the vestal |
| <i>Udea ferrugalis</i> Hübn. | |

species (Table 1). The mix of notable species comprises an interesting collection of cliff (nine species), sand-dune (two species) and woodland (three species) species. In fact, out of the total 331 species recorded, I have calculated that 30 were cliff species, 32 were sand-dune species, 62 were woodland species (including 22 wet woodland species), 24 were scrubland species and 10 were wetland species (Table 2).

The status of *Phycitodes maritima* has recently been revised by Parsons (1993) and is now provisionally classed as notable (a downward revision from notable status B), i.e. its distribution is insufficiently known for detailed classification.

Bill Kittle found signs of larvae of *Sesia bembeciformis* Hübn. feeding in willow on Polgaver Beach, but there was heavy predation by green woodpeckers and this moth may no longer be present here.

The beach has proved to be of exceptional value for migrants during this period, when 13 migrant species were recorded (Table 3).

DISCUSSION

Migrants

We did well for migrants at the site. Although moths may arrive at the site at random, they are likely to stay at Carlyon Bay where there are nectar sources and hiding places, thus increasing the chance of encounters by visiting entomologists. They can only leave the site by flying out to sea or upwards over the steep cliff. Some

migrants may breed here. For example, *Mythimna l-album* is probably a temporary resident here; although most specimens were recorded in September and October, the single found here on 19.vi.1992 may well have been a first-brood specimen.

A single specimen of *Earias clorana* was caught by Bill Kittle at mercury vapour light at Shorthorn Beach on 13.vi.92. It was an unusually marked form, subsequently determined by Barry Goater as ab *flavimargo* de Joannis. *E. clorana* is unknown from Cornwall and generally rare in the south-west. (A single *clorana* caught near Exeter by A.H. Dobson on 26.vi.92 was thought to be a migrant). It was therefore at first thought that this specimen was *Earias insulana* (Boisd.) (the Egyptian bollworm), the third British (and first Cornish) record of this rare migrant. It was exhibited as this species (Skinner, 1993), at the 1992 B.E.N.H.S. Annual Exhibition.

Work by Roy McCormick has shown that *E. clorana* occurs commonly on at least one coastal site in Devon. It is therefore possible that this species is breeding at Carlyon Bay, where the damp willow woodland provides a suitable habitat. However, Goater (1994) writes that the British populations of *E. clorana* are apparently invariable apart from size, and Martin Honey (pers. comm.) suggests that ab *flavimargo* has not apparently been recorded in Britain within breeding populations. Examples of ab *flavimargo* such as that taken on 25.vi.1992 by S.A. Knill-Jones on the Isle of Wight (and exhibited at the 1994 B.E.N.H.S. Annual Exhibition (Knill-Jones, 1995) are certainly migrants. Ab *flavimargo* has been recorded from Brittany and it is therefore likely that the singleton recorded at Carlyon Bay was a migrant from France.

Habitats and national importance

Table 2 classifies moths according to habitats which can be found at Carlyon Bay. All the species recorded at Carlyon Bay can fly and therefore may have come from neighbouring areas, but I consider this site to be largely a closed community (apart from migrants) surrounded as it is by cliffs on one side and the sea on the other.

Carlyon Bay is of some importance in national terms (Tables 1 and 4), but no red Data Book species were recorded there. Emmet (1991) allocated species to the principal habitats in which they are commonly found. He divided maritime habitats into five subsections (salt-marsh, sand-dune, cliff and undercliff, shingle beach and 'other maritime situations'). I have calculated from this list that there are a total of 358 maritime species (excluding all butterflies and migrant species) found in Britain and Ireland, not counting those generalist species that can be found anywhere. Several of these species can be found in more than one of these habitats, so that adding up the number of species in each of these habitats gives a total of 451 species. A small proportion (average 13%) of these have been recorded at Carlyon Bay (Table 4). It

Table 4. Numbers of moth species found in maritime habitats.

| Habitat type | Britain & Ireland nos* | Carlyon Bay nos | % of total for Britain & Ireland |
|---------------------------|------------------------------|--------------------|--|
| Salt-marsh | 57 | 4 | 7 |
| Sand-dune | 133 | 23 | 17 |
| Cliff and undercliff | 119 | 23 | 19 |
| Shingle beach | 50 | 5 | 10 |
| Other maritime situations | 92 | 10 | 11 |
| Totals | 451 | 64 | average 13 |

*According to Emmet & Heath (1991) habitat classification.

would be useful to compare the proportion of maritime species here with those at other coastal sites. This would allow us to build up a picture of the relative importance in national terms of coastal sites for moths.

Some of the moths recorded here (e.g. *Cucullia chamomillae* and *Malacosoma neustria*) have no close association with maritime habitats according to Emmet & Heath (1991), although all can be found regularly in coastal situations in Cornwall. This shows how regional variations in habitat preference can modify the overall picture (and also explains why the species totals in Table 2 differ from those in Table 4).

Local importance

The interest of the site lies mainly in the juxtaposition of widely different habitats and the moths that live there. I estimate that there are 32 resident macro-moths found in Cornwall which are restricted to coastal areas (Table 5). Of these 18 (56%) have been recorded at Carlyon Bay, making it a very important coastal site for Lepidoptera in local terms.

Table 5. Resident Macro-moths in Cornwall with a distribution largely restricted to the coast.

| Species name | Recorded at Carlyon Bay? (Y = yes N = no) |
|--|--|
| <i>Agrotis ripae</i> Hübn. | Y |
| <i>Agrotis trux</i> Hübn. | Y |
| <i>Agrotis vestigialis</i> Hufn. | Y |
| <i>Aporophyla australis</i> Boisd. | N |
| <i>Aspitates ochrearia</i> Rossi | N |
| <i>Bembecia muscaeformis</i> Esp. | Y |
| <i>Catarhoe rubidata</i> D.&S. | Y |
| <i>Cucullia chamomillae</i> D.&S. | Y |
| <i>Dasyptolia templi</i> Thunb. | N |
| <i>Eilema complana</i> L. | N |
| <i>Eilema caniola</i> Hübn. | Y |
| <i>Epirrhoe galiata</i> D.&S. | Y |
| <i>Eupithecia denotata jasionaeata</i> Crewe | N |
| <i>Eupithecia distinctaria</i> H.-S. | Y |
| <i>Eupithecia simpliciatata</i> Haw. | Y |
| <i>Euxoa nigricans</i> L. | N |
| <i>Euxoa obelisca</i> D.&S. | N |
| <i>Euxoa tritici</i> L. | Y |
| <i>Gnophos obscurata</i> D.&S. | N |
| <i>Hadena luteago barrettii</i> Doubl. | Y |
| <i>Hadena perplexa</i> D.&S. | Y |
| <i>Hyloicus pinastri</i> L. | N |
| <i>Leucochlaena oditis</i> Hübn. | N |
| <i>Luperina nickerlii leechi</i> Goater | N |
| <i>Lygephila cracca</i> D.&S. | N |
| <i>Meganola albula</i> D.&S. | Y |
| <i>Mythimna l-album</i> L. | Y |
| <i>Mythimna litoralis</i> Curt. | Y |
| <i>Mythimna putrescens</i> Hübn. | Y |
| <i>Nudaria mundana</i> L. | N |
| <i>Polymixis xanthomista</i> Hübn. | Y |
| <i>Standfussiana lucerneae</i> L. | N |

Meganola albula D.&S. (Kent black arches)

Paul Siddons and I found two specimens (one male and one female) of *Meganola albula* at mercury vapour light at Shorthorn beach on 10.vii.92. This is the only site so far in Cornwall for this species. I had been hoping for some time to find this nationally scarce species on the Cornish coast as it has been recorded both sides of Cornwall on the Isles of Scilly and in Devon (Heath & Emmet, 1979). In fact, the records for Scilly are all pre-1980 (Waring, 1992). The only records I can find for Scilly were in 1956, 1957 and 1959 from Tresco, Bryher and St Agnes (per the Cornish Biological Records Unit). Nevertheless, the discovery (although accidental) of *M. albula* here shows that distribution maps can be used to provide clues to where species may be found.

In Britain, *Meganola albula* is a southern species largely confined to the coast but occasionally found inland in woodland clearings. The open woodland habitat here looks ideal. The main foodplant in Britain is considered to be *Rubus caesius* L. (Skinner, 1984), but I could find no trace of this plant here (although Lousley (1971) states that there are several records for the Isles of Scilly). The moth is also known to feed on *Potentilla* and *Fragaria*, but Bill Kittle and I found no sign of larvae on these plants during spring 1993. In fact, we saw no adults in 1993 despite extensive trapping on the site. Unfortunately, a large part of the site had been bulldozed to make a road for construction vehicles and it may be that *M. albula* no longer occurs here (Spalding, in press).

Foodplants

The list of larval foodplants associated with the species recorded at Carlyon Bay. (Table 6) shows the plant species that are likely to occur here. New (1991) suggests

Table 6. Number of moth species (excluding migrants) associated with particular foodplants at Carlyon Bay.

| | |
|--|-----|
| <i>Pulicaria dysenterica</i> (L.) Bernh. | 1 |
| <i>Lonicera periclymenum</i> L. | 1 |
| <i>Oenanthe crocata</i> L. | 1 |
| <i>Typha</i> spp. | 1 |
| <i>Betula</i> spp. | 2 |
| <i>Thymus polytrichus</i> A. Kerner ex Borbas (= <i>T. praecox</i>) | 2 |
| <i>Phragmites</i> | 2 |
| <i>Tripleurospermum maritimum</i> (L.) Koch | 2 |
| <i>Armeria maritima</i> (Miller) Willd. | 3 |
| <i>Calluna vulgaris</i> (L.) Hull | 4 |
| <i>Silene uniflora</i> Roth (= <i>S. maritima</i>) | 4 |
| <i>Atriplex/Chenopodium</i> | 4 |
| Lichen spp. | 7 |
| Conifer spp. | 7 |
| <i>Quercus</i> spp. | 8 |
| <i>Salix</i> spp. | 21 |
| Gramineae | 33 |
| General polyphagous species | 20 |
| Polyphagous on herbaceous plants | 48 |
| Polyphagous on trees and shrubs | 48 |
| Others | 98 |
| [Hymenoptera nests | 1] |
| Total | 318 |

that there may be a complicated relationship between butterflies and hostplant diversity and this is likely to be true of moths. Plant diversity is high at Carlyon Bay because of the number of different habitats and their associated plants, the early successional stage of the dune vegetation which is constantly changing and the recent disturbance of the area which has led to colonization by so-called 'weed' species.

However, some moths have occurred at Carlyon Bay despite the apparent absence of their foodplant. I could find no sign of *Phragmites australis* (Cav.) Trin. ex Steudel in Carlyon Bay, although two moths (*Archanara geminipuncta* and *Rhizedra lutosa*) associated with this foodplant were recorded there. It is well known that *Rhizedra lutosa* can be found at some distance from its foodplant (Skinner, 1984), but *Archanara geminipuncta* is generally considered to be less mobile. In fact, *Phragmites* probably occurred here in previous years near the adit (D. Gibbon, pers. comm.).

The abundance of a foodplant at a site has no apparent bearing on the number of moth species that feed on it. *Armeria maritima* (Miller) Willd. is abundant here but only three moth species feed on it. Conifer trees are scarce, yet seven moth species with conifer-feeding larvae were present on the site, including *Bupalus piniaria* which is particularly rare in east Cornwall.

The community of sand-dune moths at Carlyon Bay

I have calculated from foodplant associations and other factors that there are 32 species associated with the sand-dunes at Carlyon Bay (Table 7), excluding generalist species found in a wide variety of situations. (The figure of 32 differs from Emmet's 23 out of 133 (Table 4) because it is based on local knowledge). These species form a maritime community of moths, apparently a random assemblage of species but probably linked together by a variety of factors such as the structural diversity, historical continuity and maritime aspect of the site, as well as the presence of shared food resources. (e.g. seven species feed on grasses). No attempt was made to assess the abundance of species on this site.

The ecology of most (perhaps all) of the species found here is so poorly understood that we cannot say with certainty which (if any) factors are common to all or most of the species. Several of these species form guilds sharing a common foodplant (e.g. three species feed on *Atriplex* and two on *Taraxacum*), but may utilize different parts of the foodplant at different times of year. The foodplant resource at this site is probably sufficient for the guilds of moths here so that interspecific competition for food is unlikely. (Porter et al (1992) says that there is no clear-cut case of competitive exclusion among British butterflies, but it is possible that competitive exclusion is more common among British moths because there are so many more species on a site such as this.) The moths are here partly because their larval foodplants are present. Their national distributions may be linked to the distribution of the foodplants, but there are other limiting factors such as the prevalence of parasites etc. Moths such as *Mythimna l-album* are probably confined as breeding populations to the frost-free areas on the warm southern cliffs. In Cornwall, *Cucullia chamomillae* is largely confined to the coast, despite the fact that its foodplant (*Tripleurospermum maritimum*) is widespread throughout the county. For these species, the restricted coastal distribution implies that factors other than the availability of foodplant limit their distribution.

Numbers of species

The total of 331 species represents the results of several nights trapping; 83 Geometridae and 118 Noctuidae were recorded. However, some families such as the

Table 7. Sand-dune moths at Carlyon Bay.

| Species name | Moth | | Foodplant | |
|--|------|----------------------------|-------------------------|----------------------------|
| | | Close coastal association? | Species | Close coastal association? |
| <i>Agriphila geniculea</i> Haw. | | Y | grasses | N |
| <i>Agrotis clavis</i> Hufn. | | Y | herb. plants | N |
| <i>Agrotis ripae</i> Hübn. | | Y | dune plants | Y |
| <i>Agrotis vestigialis</i> Hufn. | | Y | grasses etc | N |
| <i>Amphipoea oculca</i> L. | | Y | grasses | N |
| <i>Caradrina clavipalpis</i> Scop. | | N | grasses | N |
| <i>Celypha striana</i> D.&S. | | N | <i>Taraxacum</i> | N |
| <i>Cucullia chamomillae</i> D.&S. | | Y | <i>Tripleurospermum</i> | N |
| <i>Discestra trifolii</i> Hufn. | | N | <i>Atriplex</i> etc. | N |
| <i>Endotricha flammealis</i> D.&S. | | N | polyphagous | N |
| <i>Epirrhoe galiata</i> D.&S. | | Y | <i>Galium</i> | N |
| <i>Eumichtis lichenea</i> Hübn. | | N | polyphagous | N |
| <i>Eupithecia absinthiata</i> Cl. | | N | polyphagous | N |
| <i>Eupithecia simpliciatata</i> Haw. | | Y | <i>Atriplex</i> etc. | N |
| <i>Eupithecia virgaureata</i> Doubl. | | Y | <i>Senecio</i> etc. | N |
| <i>Euxoa tritici</i> L. | | Y | polyphagous | N |
| <i>Idaea subsericeata</i> Haw. | | N | <i>Taraxacum</i> | N |
| <i>Hadena luteago barrettii</i> Doubl. | | Y | <i>Silene uniflora</i> | Y |
| <i>Lacanobia oleracea</i> L. | | Y | <i>Atriplex</i> etc. | N |
| <i>Luperina testacea</i> D.&S. | | Y | grasses | N |
| <i>Meganola albula</i> D.&S. | | Y | <i>Rubus</i> etc. | N |
| <i>Mesoligia furuncula</i> D.&S. | | Y | grasses | N |
| <i>Mythimna l-album</i> L. | | Y | grasses | N |
| <i>Mythimna litoralis</i> Curt. | | Y | <i>Ammophila</i> | Y |
| <i>Paradiarsia glareosa</i> Esp. | | N | polyphagous | N |
| <i>Perizoma alchemillata</i> L. | | N | <i>Galeopsis</i> | N |
| <i>Perizoma flavofasciata</i> Thunb. | | Y | <i>Silene</i> spp. | N |
| <i>Phycitodes maritima</i> Tengst. | | Y | <i>Achillea</i> etc. | N |
| <i>Phycitodes saxicola</i> Vaugh. | | Y | <i>Anthemis</i> etc. | N |
| <i>Scotopteryx chenopodiata</i> L. | | Y | <i>Vicia</i> etc. | N |
| <i>Semiothisa alternaria</i> Hübn. | | N | <i>Salix</i> etc. | N |
| <i>Teleiopsis diffinis</i> Haw. | | N | <i>Rumex acetosella</i> | N |

Gracillariidae, Coleophoridae and Elachistidae (one species each) were under-recorded, indicating an over-reliance on the attractiveness of light to moths on our part. It is likely that there are many more species still to be found on the site.

SUMMARY

The national importance of a site such as Carlyon Bay for moths may be evaluated according to the number of nationally notable species present. However, this method concentrates on a small proportion of the total number of species and ignores the communities of moths present. An alternative method is to calculate the proportion of species present which are representative of the types of habitat available to the moths. Emmet's classification of all British species allows us to do this on a national scale. On this basis, Carlyon Bay has 13% of the maritime species of Britain. Carlyon Bay also has 56% of the Cornish maritime macro-moths, making it important in local terms. Taking one habitat (sand-dune), this site has 17% of the sand-dune species

nationally, but with local knowledge we can list 32 species with close links to this habitat. Many species are here partly because their larval foodplants are present, but the disparity between the distribution of foodplants and of moths indicates that factors other than the availability of foodplant limit the distribution of these sand-dune moths.

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CLARENCE BRIND

11.vii.92 was the night we made the first capture of *Meganola albula* for Cornwall. Clarence Brind shared this moment with us. It was unfortunately the last moth trip I went on with Clarence, who died on 8.ii.93. Clarence was well known in Cornwall and beyond as a real enthusiast for all kinds of wildlife. During the course of his life, he built up a huge collection of insects from around the world stored in several hundred large display boxes. Unfortunately, I never knew Clarence as well as I would have wished, but I was privileged to accompany him on several nocturnal mothing trips and will always remember his sense of humour, his knowledge and above all his keen appreciation of the beauty of all living things.

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APPENDIX. LIST OF SPECIES RECORDED FROM THE STUDY AREA

- Hepialidae. *Hepialus humuli* L.
- Incurvariidae. *Nematopogon swammerdamella* L., *Nemophora degeerella* L.
- Gracillariidae. *Parornix anglicella* Stt.
- Sesiidae. *Sesia bembeciformis* Hübn., *Bembecia muscaeformis* Esp.
- Yponomeutidae. *Argyresthia brockeella* Hübn., *Argyresthia retinella* Zell., *Yponomeuta padella* L., *Paraswanmerdamia albicapitella* Scharf., *Ypsolopha parenthesesella* L., *Ypsolopha ustella* Cl., *Plutella xylostella* L.
- Coleophoridae. *Coleophora albicosta* Haw.
- Elachistidae. *Elachista canapennella* Hübn.
- Oecophoridae. *Hofmannophila pseudospretella* Stt., *Carcina quercana* F., *Depressaria daucella* D.&S., *Agonopterix heracliana* L., *Agonopterix subpropinquella* Stt., *Agonopterix arenella* D.&S., *Agonopterix ocellana* F., *Agonopterix assimilella* Treit., *Agonopterix nervosa* Haw.
- Gelechiidae. *Aristotelia ericinella* Zell., *Teleiopsis diffinis* Haw., *Scrobipalpa costella* Humph. & Westw., *Caryocolum blandella* Dougl., *Anarsia spartiella* Schr., *Hypatima rhomboidella* L., *Brachmia blandella* F.
- Tortricidae. *Phtheochroa inopiana* Haw., *Cochylimorpha straminea* Haw., *Agapeta hamana* L., *Agapeta zoegana* L., *Eupoecilia angustana* Hübn., *Pandemis cerasana* Hübn., *Pandemis heparana* D.&S., *Archips podana* Scop., *Clepsis consimilana* Hübn., *Epiphyas postvittana* Walk., *Lozotaenia forsterana* F., *Titula angustiorana* Haw., *Cnephasia stephensiana* Doubl., *Cnephasia asseclana* D.&S., *Acleris variegana* D.&S., *Acleris hastiana* L., *Acleris emargana* F., *Celypha striana* D.&S., *Olethreutes lacunana* D.&S., *Olethreutes bifasciana* Haw., *Hedya pruniana* Hübn., *Hedya dimidioalba* Retz., *Endothenia marginana* Haw., *Lobesia littoralis* Humph. & Westw., *Bactra lancealana* Hübn., *Epinotia immundana* F.v.R., *Epinotia nisella* Cl., *Rhopobota myrtillana* Humph. & Westw., *Epiblema uddmanniana* L., *Epiblema rosaeolana* Doubl., *Eucosma cana* Haw., *Spilonota ocellana* D.&S., *Pammene argyrana* Hübn., *Cydia succedana* D.&S., *Cydia splendana* Hübn.
- Alucitidae. *Alucita hexadactyla* L.
- Pyrilidae. *Chrysoteuchia culmella* L., *Crambus perlella* Scop., *Agriphila straminella* D.&S., *Agriphila tristella* D.&S., *Agriphila geniculea* Haw., *Catoptria pinella* L., *Platytes cerussella* D.&S., *Scoparia ambigua* Treit., *Dipleurina lacustrata* Panz., *Eudonia angustea* Curt., *Eudonia mercurella* L., *Eurrhyncha hortulata* L., *Perinephela lancealis* D.&S., *Phlyctaenia coronata* Hufn., *Ebulea crocealis* Hübn., *Udea olivalis* D.&S., *Udea ferrugalis* Hübn., *Mecyna asinalis* Hübn., *Nomophila noctuella* D.&S., *Pleuroptya ruralis* Scop., *Hypsopygia costalis* F., *Endotricha flammealis* D.&S., *Aphomia sociella* L., *Numonia advenella* Zinck., *Phycita roborella* D.&S., *Pempeliella diluta* Haw., *Homoeosoma sinuella* F., *Phycitodes saxicola* Vaugh., *Phycitodes maritima* Tengst.
- Pterophoridae. *Pterophorus pentadactyla* L.
- Lasiocampidae. *Malacosoma neustria* L., *Lasiocampa quercus* L., *Macrothylacia rubi* L., *Philudoria potatoria* L.
- Drepanidae. *Drepana falcataria* L., *Cilix glaucata* Scop.
- Thyatriridae. *Thyatira batis* L., *Habrosyne pyritoides* Hufn., *Ochropacha duplaris* L.
- Geometridae. *Alsophila aescularia* D.&S., *Hemiteha aestivaria* Hübn., *Timandra griseata* Peters, *Scopula imitaria* Hübn., *Scopula immutata* Linn., *Scopula floslactata* Haw., *Idaea biselata* Hufn., *Idaea fuscovenosa* Goeze, *Idaea dimidiata* Hufn., *Idaea subsericeata* Haw., *Idaea aversata* L., *Rhodometra sacraria* L., *Orthonama obstipata* F., *Xanthorhoe spadicearia* D.&S., *Xanthorhoe ferrugata* Cl., *Xanthorhoe montanata* D.&S., *Xanthorhoe fluctuata* L., *Scotopteryx chenopodiata* L., *Catarhoe rubidata* D.&S., *Catarhoe cuculata* Hufn., *Epirrhoe alternata* Müll., *Epirrhoe galiata* D.&S., *Campptogramma bilineata* L., *Anticlea badiata* D.&S., *Anticlea derivata* D.&S., *Lampropteryx suffumata* D.&S., *Cosmorrhoe ocellata* L., *Ecliptopera silaceata* D.&S.,

Chloroclysta truncata Hufn., *Cidaria fulvata* Forst., *Thera firmata* Hübn., *Thera obeliscata* Hübn., *Thera britannica* Turn., *Electrophaes corylata* Thunb., *Colostygia pectinataria* Knoch, *Hydriomena furcata* Thunb., *Perizoma affinitata* Steph., *Perizoma alchemillata* L., *Perizoma flavofasciata* Thunb., *Eupithecia tenuitata* Hübn., *Eupithecia pulchellata* Steph., *Eupithecia venosata* F., *Eupithecia centaureata* D.&S., *Eupithecia absinthiata* Cl., *Eupithecia vulgata* Haw., *Eupithecia subfuscata* Haw., *Eupithecia simplicata* Haw., *Eupithecia distinctaria* H.-S., *Eupithecia nanata* Hübn., *Eupithecia virgaureata* Doubl., *Eupithecia abbreviata* Steph., *Eupithecia dodoneata* Guen., *Chloroclystis v-ata* Haw., *Chloroclystis rectangularata* L., *Gymnoscellis rufifasciata* Haw., *Euchoeca nebulata* Scop., *Asthena albulata* Hufn., *Trichopteryx carpinata* Borkh., *Pterapherapteryx sexalata* Retz., *Acasis viretata* Hübn., *Abraxas grossulariata* L., *Lomaspilis marginata* L., *Semiothisa alternaria* Hübn., *Petrophora chlorosata* Scop., *Opisthograptis luteolata* L., *Epione repandaria* Hufn., *Apeira syringaria* L., *Ennomos alniaria* L., *Selenia dentaria* F., *Odontopera bidentata* Cl., *Crocallis elinguaria* L., *Ourapteryx sambucaria* L., *Biston betularia* L., *Peribatodes rhomboidaria* D.&S., *Alcis repandata* L., *Cleorodes lichenaria* Hufn., *Ectropis crepuscularia* D.&S., *Bupalus piniaria* L., *Cabera pusaria* L., *Cabera exanthemata* Scop., *Lomographa temerata* D.&S., *Campaea margaritata* L., *Hylaea fasciaria* L.

Sphingidae. *Sphinx ligustri* L., *Laothoe populi* L., *Deilephila elpenor* L., *Deilephila porcellus* L.

Notodontidae. *Phalera bucephala* L., *Cerura vinula* L., *Notodonta dromedarius* L., *Eligmodonta ziczac* L., *Pheosia gnoma* F., *Pheosia tremula* Cl., *Ptilodon capucina* L., *Pterostoma palpina* Cl., *Drymonia ruficornis* Hufn.

Lymantriidae. *Dasychira pudibunda* L., *Lymantria monacha* L.

Arctiidae. *Miltochrista miniata* Forst., *Eilema griseola* Hübn., *Eilema caniola* Hübn., *Eilema lurideola* Zinck., *Spilosoma lubricipeda* L., *Spilosoma luteum* Hufn., *Phragmatobia fuliginosa* L.

Nolidae. *Meganola albula* D.&S., *Nola confusalis* H.-S.

Noctuidae. *Euxoa tritici* L., *Agrotis vestigialis* Hufn., *Agrotis segetum* D.&S., *Agrotis clavus* Hufn., *Agrotis exclamationis* L., *Agrotis trux* Hübn., *Agrotis ipsilon* Hufn., *Agrotis puta* Hübn., *Agrotis ripae* Hübn., *Axylia putris* L., *Ochropleura plecta* L., *Noctua pronuba* L., *Noctua comes* Hübn., *Noctua janthina* D.&S., *Noctua interjecta* Hübn., *Paradiarsia glareosa* Esp., *Lycophotia porphyrea* D.&S., *Peridroma saucia* Hübn., *Diarsia mendica* F., *Diarsia rubi* View., *Xestia c-nigrum* L., *Xestia triangulum* Hufn., *Xestia xanthographa* D.&S., *Xestia agathina* Dup., *Naenia typica* L., *Anaplectoides prasina* D.&S., *Cerastis rubricosa* D.&S., *Discestra trifolii* Hufn., *Polia nebulosa* Hufn., *Mamestra brassicae* L., *Melanchnra persicariae* L., *Lacanobia oleracea* L., *Hecatera bicolorata* Hufn., *Hadena perplexa* D.&S., *Hadena luteago barrettii* Doubl., *Hadena confusa* Hufn., *Hadena bicurvis* Hufn., *Tholera decimalis* Poda, *Panolis flammea* D.&S., *Orthosia cerasi* F., *Orthosia incerta* Hufn., *Orthosia gothica* L., *Mythimna ferrago* F., *Mythimna albipuncta* D.&S., *Mythimna vitellina* Hübn., *Mythimna impura* Hübn., *Mythimna pallens* L., *Mythimna litoralis* Curt., *Mythimna l-album* L., *Mythimna comma* L., *Mythimna putrescens* Hübn., *Mythimna loreyi* Dup., *Cucullia chamomillae* D.&S., *Apophyla nigra* Haw., *Xylocampa areola* Esp., *Dichonia aprilina* L., *Polymixis flavicincta* D.&S., *Polymixis xanthomista* Hübn., *Eumichtis lichenea* Hübn., *Conistra vaccinii* L., *Conistra rubiginea* D.&S., *Agrochola lota* Cl., *Xanthia togata* Esp., *Acrionicta megecephala* D.&S., *Acrionicta leporina* L., *Acrionicta alni* L., *Acrionicta psi* L., *Acrionicta rumicis* L., *Craniophora ligustri* D.&S., *Cryphia muralis* Forst., *Amphipyra pyramidea* L., *Mormo maura* L., *Rusina ferruginea* Esp., *Euplexia lucipara* L., *Phlogophora meticulosa* L., *Cosmia trapezina* L., *Apamea monolypha* Hufn., *Apamea lithoxyloae* D.&S., *Apamea crenata* Hufn., *Apamea remissa* Hübn., *Apamea scolopacina* Esp., *Oligia strigilis* L., *Oligia versicolor* Borkh., *Oligia latruncula* D.&S., *Oligia fasciuncula* Haw., *Mesoligia furuncula* D.&S., *Mesoligia litorosa* Haw., *Mesapamea scalis* L., *Luperina testacea* D.&S., *Amphipoea oculata* L., *Hydraecia micacea* Esp., *Gortyna flavago* D.&S., *Nonagria typhae* Thunb., *Archanara geminipuncta* Haw., *Rhizedra lutosa* Hübn., *Charanyca trigrammica* Hufn., *Hoplodrina alsines* Brahm., *Hoplodrina blanda* D.&S., *Caradrina morpheus* Hufn., *Caradrina clavipalpis* Scop., *Heliothis armigera* Hübn., *Protodeltote pygarga* Hufn., *Earias clorana* L., *Pseudoips fagana* F., *Nycteola revayana* Scop., *Colocasia coryli* L., *Diachrysis chrysitis* L., *Autographa gamma* L., *Autographa pulchrina* Haw., *Autographa jota* L., *Aprostola trigemina* Werneb., *Aprostola triplasia* L., *Scoliopteryx libatrix* L., *Rivula sericealis* Scop., *Hypena proboscidalis* L., *Schranksia taenialis* Hübn., *Herminia tarsipennalis* Treit., *Herminia grisealis* D.&S.